BEST AVAILABLE IMAGES

Defective images within this document are accurate representation of The original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : C05G 3/00, C05F 11/10

A1

(11) International Publication Number: WO 99/07654

(43) International Publication Date: 18 February 1999 (18.02.99)

(21) International Application Number: PCT/IL98/00322

(22) International Filing Date: 9 July 1998 (09.07.98)

(30) Priority Data:
121496 7 August 1997 (07.08.97) IL

(71) Applicant *(for all designated States except US)*: BEN GURION UNIVERSITY OF THE NEGEV RESEARCH AND DEVELOPMENT AUTHORITY [IL/IL]; P.O. Box 1025, 84105 Sheva (IL).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: MARKUS, Arie [IL/IL]; Apt. 21, Byalik 151, 84308 Beer-Sheva (IL). WIESMAN, Zeev [IL/IL]; Sivchi Street 7, 85338 Lehavim (IL). WOLF, David [IL/IL]; Hazait Street 1, 84965 Omer (IL).

(74) Agent: WOLFF, BREGMAN AND GOLLER; P.O. Box 1352, 91013 Jerusalem (IL).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: ENCAPSULATED FERTILIZERS

(57) Abstract

The invention provides a controlled-release encapsulated fertilizer comprising a core containing at least one fertilizer and a polymeric envelope containing at least one hormone encapsulating said fertilizer.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5413856 A	09-05-1995	NONE	
US 3323898 A	06-06-1967	NONE	
WO 9746590 A	11-12-1997	AU 3229797 A	05-01-1998
US 4704160 A	03-11-1987	AU 576564 B	01-09-1988
		AU 4055285 A	10-10-1985
		CA 1251652 A	28-03-1989
		DE 3587705 D	10-02-1994
		DE 3587705 T	28-04-1994
		EP 0160210 A	06-11-1985
		JP 60246289 A	05-12-1985
		US 4824473 A	25-04-1989

ENCAPSULATED FERTILIZERS

Technical Field

The present invention relates to controlled-release encapsulated fertilizer.

More particularly, the present invention relates to a controlled-release encapsulated fertilizer comprising a core containing at least one fertilizer and a polymeric envelope containing at least one hormone encapsulating said fertilizer

Background Art

The encapsulating of various chemical reagents, pharmaceuticals, pesticides and herbicides in general have been proposed and described in the prior art.

As described e.g. in U. S. Patent 4,417,916, aqueous dispersions of pesticide and herbicide micro-capsules are particularly useful in controlled release pesticidal and herbicidal formulations because they can be diluted with water or liquid fertilizer and sprayed using conventional equipment, thereby producing uniform field coverage of the pesticide or herbicide/additives such as film forming agents can be added directly to the finished formulation to improve the adhesion of micro-capsules to foliage. In some cases, reduced toxicity and extended activity of encapsulated herbicides and pesticides have been noted.

A variety of techniques have heretofore been used or proposed for encapsulation purposes. In one such process, known as "simple co-acervation", a polymer separates from a solvent solution of the polymer by the action of a precipitating agent that reduces the solubility of the polymer in the solvent (e.g., a salt or a non-solvent for the polymer). Patents describing such processes and their shell wall material includes U. S. Patent Nos. 2,800,458 (hydrophilic colloids); 3,069,370 and 3,116,216 (polymers); 3,137,631 (denatured proteins); 3,418,250 (hydrophobic thermoplastic resins); and others.

Another method involves micro-encapsulation based on in situ interfacial condensation polymerization. British Patent No. 1,371,179 discloses a process which consists of dispersing an organic pesticide phase containing a polymethylene polyphenylisocyanate or toluylene diisocyanate monomer into an aqueous phase. The wall forming reaction is initiated by heating the batch to an elevated temperature at which point the isocyanate monomers are hydrolyzed at the interface to form amines, which in turn react with unhydrolyzed isocyanate

is the possibility of continued reaction of monomer after packaging. Unless all monomer is reacted during the preparation, there will be continued hydrolysis of the isocyanate monomer with evolution of CO_2, resulting in the development of pressure when the formulation is packaged.

Various methods of encapsulation by interfacial condensation between direct-acting, complimentary reactions are known. Within these methods are reactions for producing various types of polymers as the capsule walls. Many of such reactions to reproduce the coating substance occur between an amine, which must be of at least di-functional character and a second reactant intermediate, which for producing a polyurea is a di-functional or polyfunctional isocyanate. The amines chiefly used or proposed in these methods are typified by ethylene diamine, having at least two primary amino groups. U. S. Patent No. 3,429,827 and U. S. Patent No. 3,577,515 are illustrative of encapsulation by interfacial condensation.

For example, U. S. Patent No. 3,577,515 describes a continuous or batch method which requires a first reactant and a second reactant complimentary to the first reactant, with each reactant in separate phases, such that the first and second reactants react at the interface between the droplets to form encapsulated droplets. The process is applicable to a large variety of polycondensation reactions, i.e., to many different pairs of reactants capable of interfacial condensation from respective carrier liquids to yield solid film at the liquid interface. The resulting capsule skin may be produced as a polyamide, polysulfonamide, polyester, polycarbonate, polyurethane, polyurea or mixtures of reactants in one or both phases so as to yield corresponding condensation copolymers. The reference describes the formation of a polyurea skin when diamines or polyamines (e.g. ethylene diamine, phenylene diamine, toluylene diamine, hexamethylene diamine and the like) are present in the water phase and di-isocyanates or polyisocyanates (e.g., toluene diisocyanate, hexamethylene diisocyanate and polymethylene polyphenylisocyanate) are present in the organic/oil phase.

Several methods for coating fertilizers of such as KNO_3 and NPK have been known. Until 1981 one patent by "Sierra" disclosed the coating of osmocote (NPK). After 1981 Japanese patents Nos. 84-146,053 and 54-840,716 disclosed coated fertilizers, said fertilizers were coated with urea formaldehyde.

JP 63-162,593 discloses a fertilizer envelope. Said envelope is produced by spraying a solution of polyethylene and eva (ethyl vinyl acetate) in $CC1_2=CC1_2$ on fertilizer granules.

The world's nursery industry utilizes numerous products and techniques in order to maintain and produce millions of ornamental plants and fruit trees. The nursery industry uses sophisticated agrotechnologies and consumes large quantities of rooting stimulators. There is an ongoing need for novel products that could increase rooting percentages of difficult-to-root (mainly woody or semi-woody plant species) plants. There is also the need for improving the growth rate and quality of the plants produced by the nurseries.

A common procedure in a nursery entails the sporadic addition of fertilizers and hormones to the roots of new cuttings. The present inventors have found that the addition of a controlled-release encapsulated fertilizer can maintain the presence of the necessary compounds for the entire period of rooting and development of rooted plants.

Disclosure of the Invention

With this state of the art in mind, there has now been found, according to the present invention, a controlled-release encapsulated fertilizer comprising a core containing at least one fertilizer and a polymeric envelope containing at least one hormone encapsulating said fertilizer.

In preferred embodiments of the present invention said envelope contains at least one hormone selected from the group consisting of Auxin; indole alkyl acid; indole acetic acid(IAA); indole propionic acid(IPA); indole butyric acid(IBA); 2,4 dichlorophenoxy acetic acid; 2,4 chlorophenoxy propionic acid; 2,4 dichloro phenoxyacetic acid propyl ester; and, Naphthalene acetic acid.

In another embodiment of the present invention there is provided a process for encapsulating a fertilizer comprising:

a) coating a fertilizer with a mixture of a first monomer and a hormone;

b) adding a mixture of a second monomer and additional a hormone; and,

c) heating said mixtures to induce the polymerization of said first and second monomers to form a polymeric envelope incorporating said hormone and encapsulating said fertilizer.

wherein said envelope contains at least one hormone selected from the group consisting of Auxin; indole alkyl acid; indole acetic acid(IAA); indole propionic acid(IPA); indole butyric acid(IBA); 2,4 dichlorophenoxy acetic acid; 2,4 chlorophenoxy propionic acid; 2,4 dichloro phenoxyacetic acid propyl ester; and, Naphthalene acetic acid.

wherein said polymeric envelope is formed by a polymer selected from the group consisting of polyurethane; polyurea; and, polyolefins.

While the invention will now be described in connection with certain preferred embodiments in the following examples so that aspects thereof may be more fully understood and appreciated, it is not intended to limit the invention to these particular embodiments. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the scope of the invention as defined by the appended claims. Thus, the following examples which include preferred embodiments will serve to illustrate the practice of this invention, it being understood that the particulars shown are by way of example and for purposes of illustrative discussion of preferred embodiments of the present invention only and are presented in the cause of providing what is believed to be the most useful and readily understood description of formulation procedures, as well as of the principles and conceptual aspects of the invention.

Description of Preferred Embodiments

Examples:

A series of formulations were prepared according to the present invention. As stated, according to the invention the fertilizer is the core of the formulation and the hormone is incorporated in the envelope. The hormones that were incorporated in the slow release formulations were from the following families:

- Auxin - Indole alkyl acid IAA (Indole alkyl acid) ,
  IPA (Indole Propionic Acid) and IBA (Indole Butynic Acid)
  - 2,4 Dichlorophenoxy acetic acid
  - 2,4 Dichlorophenoxy acetic propionic acid

2,4 Dichloro phenoxyacetic acetic acid propyl ester

- Naphthalene acetic acid (NAA) auxin stimulated root regeneration and development

- Triazole - Paclobutrazole (growth retardant that has an anti-gibberllin-enhanching effect on stimulation of root formation and increasing survival of rooted pland grown in stress conditions.
- Cytokinine - Benzoyladenine (plant hormone that stimulates development and branching of shoots)

The coating consists of the following families of polymers:

- polyurethane
- polyurea
- polyolefis (like polyethylene) etc

Carbohydrates such as sucrose, starch, etc. that are enhancing auxin effect on stimulation of root regeneration and development are added to the envelope. Other materials that are added to the formulation are to increase the nutritional content (micro elements such as: Fe, B, Mg, Zn, Mn, Ca, Mo, etc.), to increase biotic tolerance (Benedate), Falpane, Merpan, Prochloraz, propionazol, diazinone, nephorex, etc), and to increase a biotic tolernace of the plants (triazole compounds such as majic that increase drought resistance by stimulation of wax cover of the leaves).

The above mentioned hormones increase the rate of cell division and differentiation and the result of said increased rate is a stimulation of root regeneration and development.

Growth retardants such as Triazole e.g. paclobutrazole can also be added. Said retardant has an anti-gibberllin-enhancing auxin effect on stimulation of root formation. Other materials that are added to the formulation are to increase biotic (pathogens) and abiotic (drought) tolerance of plants.

Hormones can also be added to the core if desired.

Procedure:

The granules of fertilizer were put in a coating pan and one monomer with part of the hormone was added. The coating pan rotated until the granules were

covered with one monomer containing part of the hormones, then a second monomer with the rest of the hormones and catalyst were added. The coating pan rotated and the mixture was heated up to 50 °C. When the condensation polymerization ended, and when the granules are not sticky, talcum was added followed by melted wax. The coating pan was rotated continuously. The formulation is then put in bags.

The formulations are summarized in Table 1:

Table 1 Envelop formulation on fertilizer (KNO_3, MKP)

Example No.	Amount KNO_3, g	Amount Voranate M580, g	Glycols		Hormones				Extrusion	
			Type	Amount, g	type	amount	Talc, g	Wax, g	Fertilizer %	Polyethylene %
1 (A1)	100	10	PEG-600	10	2-4DP	1	5	5		
2. (A12)	100	10	PEG-600	10	2-4DP	0.5	5	5		
3. (A2)	100	10	PEG-600	10	2-4D	1	5	5		
4. (A22)	100	10	PEG-600	10	2-4D	0.5	5	5		
5. (B1)	100	10	PEG-1000	10	2-4DP	1	5	5		
6. (B12)	100	10	PEG-1000	10	2-4DP	10.5		5		
7. (B2)	100	10	PEG-1000	10	2-4D	1	5	5		
8. (B22)	100	10	PEG-1000	10	2-4D	0.5	5	5		
9. (C1)	100	5	PEG-6000	15						
10. (C2)	100	5	PEG-6000	15	2-4D	1	10	5		
11. (C22)	100	5	PEG-6000	15	2-4D	0.5	10	5		
12. (D1)	100	5	PEg-12000	15	2-4DP	1	10	5		
13 (D2)	100	5	PEG-12000	15	2-4D	1	10	5		
14. (EO3)	-	-	-	-	-	-	-	-	80	20
15 (E11)	-	-	-	-	2-4DP	1	-	-	50	50
16. (E12)	-	-	-	-	2-4DP	1	-	-	70	30
17. (E42)	-	-	-	-	IBA	0.5	-	-	75	25
18 (E112)	-	-	-	-	2-4DP	0.5	-	-	50	50
19. (E512)	25g+25g MKP	-	-	-	2-4DP	0.5	-	-	50	50
20. (E532)	25g 25g MKP	-	-	-	IBA	0.5	-	-	50	50
21. (I)	100	5	EDA+DETA	0.8+0.7	IBA	0.1	15	10		+0.2g H_2O
22. (II)	100	4	EDA+DETA	1+1	2-4D	1	-	10		0.5g H_2O

Table 1 (cont)

Example No.	Amount KNO_3, g	Amount Voranate M580, g	Glycols Type	Glycols Amount, g	Hormones type	Hormones amount	Talc, g	Wax, g	Fertilizer %	Polye-thylene %
23. (III)	100	10	EDA+DETA	0.8+0.7	PB-zol	0.5	-	5		0.3 g H_2O
24. (IV)	100	5	EDA+DETA	1+1	MKP	0.1	-	10		
25. (V)	100	4	EDA+DETA	1+1	2-4-DP	0.1	-	10		
26. (VI)	100	10	EDA+DETA	1+1	2-4-DP	0.5	-	5		
27. (VII)	100	10	EDA+DETA	1+1	2-4-D+PB-zol	0.5+0.5	-	10		
28. (GSK-1)	100	10	EDA+DETA	1+1	2.4D	1	5	5		
29. (GSK-2)	100	10	EDA+DETA	1+1	2-4D	1	5	5		
30. (GSK-3)	100	10	EDA+DETA	1+1	PB-zol	1	5	5		
31. (GSK-5)	100	10	EDA+DETA	1+1	2-4 DP	1	5	5		
32. (GSK-6)	100	10	EDA+DETA	1+1	2-4DP+PB-zol	0.5+0.5	5	5		
33. (GSK-7)	100	10	EDA+DETA	1+1	2-4D+PB-zol	0.5+0.5	5	5		
34. (GSK-8)	100	10	EDA+DETA	1+1	2-4DP+PB-zol+IBA	0.5+0.5+0.5	5	5		
35. (GSK-10)	100	10	EDA+DETA	1+1	PB-zol+IBA	0.5+0.5	5	10		
36. (GSK-9)	100	10	EDA+DETA	1+1	PB-zol	0.5	-	10		
37. (GSK-11)	100	10	EDA+DETA	1+1	PB-zol+IBA+2-4D	0.5+0.5+0.5	-	10		
38. (GSK-12)	250	25	EDA+DETA	2.5+2.5	PB-zol+IBA+2DP	1.25+1.25+1.25				
39. GSK-13)	250	25	EDA+DETA	2.5+2.5	PB-zol+IBA+2DP	1.25+1.25+1.25		25	0.05 g	
40. (GSK-14)	250	30	EDA+DETA	3+3	IBA+PB-zol+2DP	1.25+1.25+1.25	-	25	0.05 g	
41. (GSK-15)	250	25	EDA+DETA	2.5+2.5	IBA+PB-zol	0.6+0.6	-	25		
42. (GSK-16)	250	30	EDTA+EDA	3+3	IBA+PB-zol+2DP	0.6+0.6+0.6	-	25		
43. (GSK-17)	250	30	DETA+EDA	3+3	IBA+PB-ZOL+2DP	0.6+0.6+0.6	-	25		
44. (GSK-18)	100	10	EDA+DETA	0.5+0.5	GA_3	0.5	5	5		
45. (GSK-19)	100	10	EDA+DETA	1+1	PB-ZOL+IBA	0.5+0.5	5	10	8g Benlate	
46. (GSK-20)	100	10	EDA+DETA	1+1	IBA+PB-zol	0.5+0.5	5	5	2g Folpane	
47. (GSK-21)	100	10	EDA+DETA	1+1	IBA+PB-zol	0.5+0.5	5	5	2g Merpan	
48. (GSK-22)	100	10	EDA+DETA	1+1	IBA=PB-zol	0.5+0.5	5	5	2g Prochloraz	

Table 1 (cont.)

Example No.	Amount KNO_3, g	Amount Voranate M580, g	Glycols		Hormones		Talc, g	Wax, g	Fertilizer %	Polyethylene %
			Type	Amount, g	type	amount				
49. (GSK-23)	100	10	EDA+DETA	1+1	IBA+PB-zol	0.5+0.5	5	5	2g Propionazol	
50. (GSK-24)	100	10	EDA+DETA	0.5+0.5	-	-	5	5	2g Diazinone	
51. (GSK-25)	100	10	EDA+DETA	0.5+0.5			5	5	5g TiGo	
52. (GSK-26)	100	10	EDA+DETA	0.5+0.5			5	5	5g Fe_2O_3	
53. (GSK-27)	100	10	EDA+DETA	0.5+0.5			5	5	1g Benzoyladenine	
54. (GSK-28	100	10	EDA+DETA	0.5+0.5			5	5	1g Benlate	
55. (GSK-29)	100	10	EDA+DETA	0.5+0.5	PB-zol	1	5	5	-	
56. (GSK-30)	100	10	EDA+DETA	0.5+0.5	-		5	5	2.25 g Merpan	
57. (GSK-31)	100	10	EDA+DETA	0.5+0.5	-		5	5	2g Starch	
58. (1)	100	10	EDA+DETA	1+1	-		5	5	0.5 g $Mg(NO_3)_2$	
59. (2)	100	10	EDA+DETA	1+1	-		5	5	0.5 g $Na_2B_4O_7$	
60. (3)	100	10	EDA+DETA	1+1	-		5	5	0.5 g $FeSO_4$	
61. (4)	100	10	EDA+DETA	1+1	-		5	5	0.5 g $Zn SO_4$	
62. (5)	100	10	EDA+DETA	1+1			5	5	0.5 g $Ca (NO_3)_2$	
63. (6)	100	10	EDA+DETA	1+1	-	-	5	5	0.5 g $MnSO_4$	
	100	10	ED+DETA	1+1	-		5	5	0.5 g $(NH_4)6MO_7O_{24}$	

Biological methods:

Each cutting was put in a vessel with special earth and with 3 granules. the cuttings were put in green houses. The amount of roots and the length of the roots were measured.

The plants utilized included were Phelargonium: roses, melloloica, olives from different clutivars, eucalyptus of different kinds and many others. The biological tests were carried out with up to 7,000 cuttings for each plant. These tests consisted of various soft cuttings easy-to-root, semi-woody cuttings medium-to-root, difficult-to-root cuttings and grasses.

Select formulations were tested.

The biological results on several kinds of plants are summarized in tables 2-7.

TABLE 2

BIOASSAY BASED ON MUNG-BEAN CUTTINGS TO TEST EFFECT OF ENCAPSULATED FERTILIZERS

Treatment	Average No. Roots	Average Root Length CM 6 Days	10 days after treatment
Control (H_2 O)	2.5	0.4	0.9
IBA	21.7	0.2	0.4
GSK-10	39.9	0.6	1.1
GSK-30	42.2	0.5	1.0

TABLE 3

EFFECT OF ENCAPSULATED FERTILIZERS GSK10 ON ROOTING OF CUTTINGS OF OLIVE CULTIVARS

Cultivar	Percent of Rooting	Average No. Root	Average Root Length (cm)
	Control		
Manzanillo	26	2.3	7.6
Barnea	49	4.0	5.0
Nabali	31	3.5	6.3
Chimlali	19	3.7	4.5
Maalot	22	1.6	5.9
	T-8 (Conventional Treatment)		
Manzanillo	48	3.6	4.2
Barnea	73	4.8	3.4
Nabali	52	4.4	5.2
Chimlali	46	5.1	4.0
Maalot	54	3.8	4.7
	GSK-10		
Manzanillo	52	5.3	8.8
Barnea	89	6.1	9.6
Nabali	61	5.8	7.2
Chimlali	58	5.6	6.6
Maalot	76	4.5	7.9

Table 4

EFFECT OF GSK-10 ON ROOTING OF VARIOUS PLANT SPECIES. THE TRAIL WAS DONE WITH 7000 CUTTINGS AT "GAT" COMMERCIAL NURSERY

Plant name	% rooting
Picus Natasha	71
Solanum blue	82
Copea shrub	94
Picus Thailand	82
Hibicus	78
Juniper espanicum	93
Juniper galwcos	55
Huniper Ramat Hnandiv	85
Cypress lemon	55
Bougainvillea Glabra (purple)	94
Bougainvillea smooth	0
Cestrum	80
Rosa indica	98
Ethrog yaman	60
Pandorea Jasmin	89
Solanum White	98
Olive-K18	84
Olive-Nabali	50
Miaforum	80
Malloloika dwarfish	95
Kles Tamun	36
Tchaltsporum jasmine	0 alive
Cypress Tota	0 with
Cypress cazoica	0 callus

Table 5

EFFECT OF GSK-10 ON DEVELOPMENT OF ROOT SYSTEM OF CUTTINGS OF EUCALYPTUS

Root system development ladder:

\+ Roots distributed in less than 25% of the pot medium

++ Roots distributed in about 50% of the pot medium

+++ Roots distribution in morethan 75% of the pot medium

Clone	Treatment		
	control	T-8	GSK-10
Anulata	++	+	++++
Gillii	+	+	+++
Ficifolia	-	+	+++
Kruseana	-	+	++
Popolnea	+	+	+++

TABLE 6

EFFECT OF ENCAPSULATED FERTILIZERS ON SHOOT DEVELOPMENT OF OLIVE ROOTED PLANTS

Treatment	Average Shoot Elongation (cm)	
	30 Days	60 days after treatment
T-8 (Conventional treatment)	2.2	4.3
A_1	1.8	4.1
A_2	4.0	7.3
B_1	3.6	6.0
C_1	2.7	6.5

TABLE 7

EFFECT OF ENCAPSULATED FERTILIZERS GSK-10 ON VEGETATIVE AND REPRODUCTIVE DEVELOPMENT OF SOLANUM BLUE ROOTED PLANTS

Treatment	Transplanting date	Average Root height CM	Average Number of flowers/plants
Conventional (T-8)	March 10	43	9
GSK-10	April 17	87	26

The release rate was determined by the following method. one gram of the granules were placed in a dissolution system. Samples were taken from the vessels and the amount released was determined in the following way: the amount of the fertilizer by conductometeric method and the amount of the hormone by HPLC.

Very promising results concerning the rate of root formation, length of roots, survival of plants and ease of high mass plant production were clearly observed.

The formulations were found to be most effective in: accelerating root formation, increasing rooting percentage, improving the quality of root system, and stimulation of young plant (vegetative and reproductive) development in comparison to untreated control and IBA talc powder (the common substance used at present for rooting in all nurseries).

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrative examples and that the present invention may be embodied in other specific forms without departing from the essential attributes thereof, and it is therefore desired that the present embodiments and examples be considered in all respects as illustrative and not restrictive, reference being made to the appended claims, rather than to the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed is:

1. A controlled-release encapsulated fertilizer comprising a core containing at least one fertilizer and a polymeric envelope containing at least one hormone encapsulating said fertilizer.

2. A controlled-release encapsulated fertilizer according to claim 1, wherein said envelope contains at least one hormone selected from the group consisting of Auxin; indole alkyl acid; indole acetic acid(IAA); indole propionic acid(IPA); indole butyric acid(IBA); 2,4 dichlorophenoxy acetic acid; 2,4 chlorophenoxy propionic acid; 2,4 dichloro phenoxyacetic acid propyl ester; and, Naphthalene acetic acid.

3. A controlled-release encapsulated fertilizer according to claim 1, wherein said polymeric envelope is formed by a polymer selected from the group consisting of polyurethane; polyurea; and, polyolefins.

4. A controlled-release encapsulated fertilizer according to claim 1, further comprising a triazole incorporated therein.

5. A controlled-release encapsulated fertilizer according to claim 4, wherein said triazole is paclobutrazole.

6. A controlled-released encapsulated fertilizer according to claim 1, further comprising a cytokinine incorporated therein.

7. A controlled-released encapsulated fertilizer according to claim 6, wherein said cytokinine is benzoyladenine.

8. A controlled-released encapsulated fertilizer according to claim according to claim 1, furhter comprising a carbohydrate incorporated therein.

9. A controlled-released encapsulated fertilizer according to claim 8, wherein said carbohydrate is selected from the group consisting of glucose, sucrose and starch.

10 A controlled-released encapsulated fertilizer according to claim 1, further comprising a fungicide incorporated therein.

11. A controlled-released encapsulated fertilizer according to claim 10, wherein said fungicide is selected from the group consisting of Benelate, folpane, merpan and propionazal.

12. A controlled-released encapsulated fertilizer according to claim 1, furhter comprising an insecticide incorporated therein.

13. A controlled-released encapsulated fertilizer according to claim 12, wherein said insecticide is diazinone or nephorex.

14. A process for encapsulating a fertilizer comprising:

a) coating a fertilizer with a mixture of a first monomer and a hormone;

b) adding a mixture of a second monomer and an additional hormone; and,

c) heating said mixtures to induce the polymerization of said first and second monomers to form a polymeric envelope incorporating said hormone and encapsulating said fertilizer.

15. A process for encapsulating a fertilizer according to claim 14, wherein said envelope contains at least one hormone selected from the group consisting of Auxin; indole alkyl acid; indole acetic acid(IAA); indole propionic acid(IPA); indole butyric acid(IBA); 2,4 dichlorophenoxy acetic acid; 2,4 dichloro phenoxyacetic acid propyl ester; and, Naphthalene acetic acid.

16. A process for encapsulating a fertilizer according to claim 14, wherein said polymeric envelope is formed by a polymer selected from the group consisting of polyurethane; polyurea; and, polyolefins.

17. A process for encapsulating a fertilizer according to claim 14, wherein said envelope contains at least one hormone selected from the group consisting of Auxin; (indole alkyl acid; indole acetic acid(IAA); indole propionic acid(IPA); indole butyric acid(IBA); 2,4 dichlorophenoxy acetic acid; 2,4 dichloro phenoxyacetic acid propyl ester; and, Naphthalene acetic acid), and further optionally comprising at least one further component selected from the group consisting of a growth retardant, a cytokinine, a carbohydrate, a fungicide and an insecticide.

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/IL 98/00322

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C05G3/00 C05F11/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C05G C05F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 413 856 A (SWARUP VIJAY ET AL) 9 May 1995 see the whole document	1-3,10, 12,14-17
A	US 3 323 898 A (HAROLD LADD PIERCE) 6 June 1967 see claims see column 2, line 48 - column 3, line 20 see column 6, line 43 - column 11, line 59	1,2, 8-10,12, 14,17
P,A	WO 97 46590 A (GORE ENTERPRISE HOLDINGS INC) 11 December 1997 see claims	1-3, 14-17
A	US 4 704 160 A (MCVEY GEORGE R ET AL) 3 November 1987 see claims	1,2,4,5

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 October 1998	28/10/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	RODRIGUEZ FONTAO, M